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ABSTRACT

Two conflicting hypotheses exist regarding how oral reading behavior patterns follow from encounter with the text. One hypothesis views them as following decoding (decoding hypothesis), and the other sees them as occurring after comprehension processes have constructed a semantic representation of the message. These hypotheses are further differentiated by comparing "word callers" (decoders) to "dialect speakers" (comprehenders), two types of readers whose miscues seem to emphasize decoding or comprehending strategies. Three experiments were conducted to determine which theory is correct about oral reading. The experiments introduced specific alterations in texts to be read orally, and measured the oral reading errors that were made on the text surrounding the alterations. The alterations were designed to monitor lexical access, syntactic/semantic integration, and intersentence integration. The results support either hypothesis, depending on the context, the type of material, and the type of reader. All three factors interact to determine whether decoding or comprehension requires more attention in reading diagnosis. (Attached are a list of references, authors' notes, and audience response to the paper following its presentation.) (RL)

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CS004 162

Oral Reading: Does It Reflect Decoding or Comprehension?[1]

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How will most elementary school teachers determine whether a child can read? The teacher likely will hand the child a book at the child's estimated reading level and will ask the child to read. That the reading is to be aloud is usually not stated but understood implicitly by both teacher and child. What reading activity is commonly found in most traditional lower elementary grade classrooms? The children will be reading aloud individually or in unison. Oral reading provides the teacher with a quick evaluation of each child's progress as well as practicing the child on at least some aspects of reading. Although oral reading is a widely used procedure, what specific components of the reading process are assessed, and what reading skills are developed by oral reading?

Two Hypotheses About Oral Reading

A general model of reading that is commonly assumed proposes that print input is first decoded into a phonological code that has most of the characteristics of an oral, verbal input. This code is then comprehended by the usual routines of language

comprehension that the child has developed for speech. These two stages of reading are usually seen as discrete stages that can be taught independently. This assumption has lead to a division of reading instruction into teaching decoding and comprehension. Decoding depends only minimally on comprehension although some investigators posit downstream effects developed from top-down models of comprehension. For example, a major aspect of Goodman's informed-guessing model (Goodman, 1967) views previously comprehended material as facilitating the decoding of print. However, these downstream influences of comprehension on decoding are usually not thought to be essential for successful decoding, but are only helpful when the contextual information is available. On the other hand, comprehension is necessarily dependent on decoding for the representation on which to operate. Except for providing the input for comprehension, however, the decoding process does not directly affect the comprehension process.

Given this rough two-stage model of reading, where does oral production fit? The motor production aspect of oral reading must be tacked onto the reading process per se because there is no production component explicit in the decoding-comprehension model. There are two general hypotheses as to when oral production is initiated in the reading process. These hypotheses are illustrat

in Figure 1.

Insert Figure 1 about here

The decoding hypothesis is that oral production is initiated immediately following decoding (point "A" in Figure 1). Oral reading then would serve to practice the initial decoding stage. In this case, there might be no comprehension of the text at all. Or oral production and comprehension might progress in parallel. Or comprehension might occur much later than the oral production, perhaps even as the reader listens to him/herself talk. Oral production is initiated on the basis of the phonological code that is the output of decoding. Children sometimes imitate speech without comprehension, so it would not seem unreasonable that beginning readers might initiate oral production on the basis of the phonological code without comprehending the message first.

The second hypothesis is that oral production is initiated only after comprehension processes have constructed a semantic representation of the message (point "B" in Figure 1). This is the comprehension hypothesis. Oral production is initiated from the semantic representation and not from the phonological code that existed at an earlier point in the process. In fact, the

verbal code may have dissolved with comprehension so that only the semantic representation remains. The oral production process, beginning with the semantic representation, resembles sentence production in its essential components. A speaker has an idea that he/she wishes to express, and so translates that idea into linguistic form and then into speech. In oral reading, the semantic representation of the printed message constitutes the idea that serves as input to the production process.

These two hypotheses are really classes of hypotheses representing variations depending on the specific conception of decoding, comprehension, and speech production. For example, comprehension is described as if it were a single process with a fixed beginning and a fixed termination. However, comprehension may be a loose collection of processing strategies, rather than a single routine. The possible variations in these two classes of hypotheses will become evident. For the moment they serve as convenient touchstones to conceptualize the question of how oral production meshes with the reading process. The two hypotheses can be differentiated further by comparing two types of readers that appear to embody each hypothesis.

Word callers. The decoding hypothesis is supported by reading disabled children labeled word callers (Smith, Goodman, & Meredith, 1976). These are children who can read aloud but who do not

understand what they have read. One would assume on the basis of their oral reading performance that they could read. However, when they are tested for comprehension of the message, they have at best a minimal understanding of what they have just read. Word callers' understanding is not improved when they are permitted to read silently. Although it is not clear what they are doing when they are silent reading, other than staring at the page, their understanding is not increased. So the problem is not that their normal comprehension process is being disrupted by the additional task of having to read aloud. In terms of our general model, then, word callers support the decoding hypothesis since their oral production must be initiated immediately following decoding, but before comprehension occurs.

At one time or another, many adults have had the experience of reading aloud without comprehending. When just learning a foreign language, many people pass through a phase when they can read aloud in the second language, but not understand what they are reading. Or when reading some particularly difficult text, like a philosophic treatise, one might read it aloud to allow more time to think about what is being said, but still might not understand what is written. It does not seem unreasonable, then, that some beginning readers might become arrested at an early point in reading acquisition such that they can read aloud based on their

decoding skills, but not comprehend the message.

There is considerable dispute, however, as to whether word callers really exist or even what the criteria are for so labeling a child. Goodman claims that "remedial reading classes are filled with youngsters in late elementary and secondary schools who can sound out words but get little meaning from their reading" (1973b, p. 491), although he adduces no statistics to support that claim. Other reading specialists claim that the number of true word callers is exceedingly small, that children who are labeled word callers by classroom teachers actually have poor decoding skills and/or poor language comprehension skills as well.

What criteria should be considered in classifying a child as a word caller? Consider the traditional definition: he/she must be able to read aloud reasonably well and not understand what was read. First, what is meant by "reasonably well"? At minimum, he/she must read at close to the typical rate for comprehending readers, with about the same number of errors, and with normal intonation. There is some question whether word callers can meet these criteria. For example, poor readers tend to read with a list intonation (Clay & Imlach, 1971). Reading with a list intonation is a clear clue to a lack of comprehension because decoding punctuation and combining that information with the meaning

of the passage leads to intonation patterns more typical of speech. Secondly, what is meant by "not understand"? The key problem here is whether the child can understand the passage if it were presented aurally. If adults have the foreign language text or the philosophy essay read aloud, they would not understand it any better than when they read it themselves. If the child does not comprehend when listening, the problem may be attributable to a general language or conceptual deficit rather than to a deficiency in reading-specific comprehension skills or in the coordination of decoding and comprehension processes.

Word callers may be related to a class of children labeled hyperlexics who are superficially similar to word callers in their reading behavior (Mehegan & Dreifuss, 1972; Silverberg & Silverberg 1967, 1968-69). The common distinguishing feature is that "they manifested an unusual and premature talent in reading [aloud] against a background of generalized failure of development, or marked impairment, of other language functions" (Mehegan & Dreifuss, 1972, p. 1106). Their reading is a voracious compulsion that frequently develops in the preschool years. In addition, they are frequently retarded, autistic, or hyperkinetic. Perhaps these children represent an extreme instance of word calling mixed with an intellectual or emotional disturbance, or they may be a qualitatively different type of reader. Given the disagreements

about both word callers and hyperlexics, careful investigations and descriptions of both are needed.

Dialect speakers. Readers whose oral reading appears to support the comprehension hypothesis are those whose oral language dialect is different from the dialect of the primers. The most salient example in the United States are children speaking a Black dialect who learn to read from primers printed in standard English. When asked to read aloud, they produce numerous "errors" in oral production, i.e., their speech does not match the speech that one would expect based on the print. However, their deviations are not arbitrary with respect to the meaning of the text. Many of these "errors" do not change the meaning of the text, but are a translation of the message into their own dialect.

Dialectal variation occurs at all linguistic levels although phonemic miscues are the most frequent in oral reading (Burke, 1973). While Black children may "mispronounce" a printed word so that it is a homophone of another English word (e.g., /ro/ for road), they still comprehend the intended meaning of the printed word (Melmed, 1973). Many other Black English responses in oral reading are morphological variations, such as dropping regular past tense and third person singular endings on verbs and plural and possessive markers on nouns (Rosen & Ames, 1972a, 1972b; Weber, 1973). Lexical substitutions also occur, for example,

bucket for pail and gym shoes for sneakers (Burke, 1973). However, we have found no studies that have reported cases where dialectal variations changed meaning more than oral reading errors of standard English speakers changed meaning.

In order to translate the text into their oral dialect without a change in meaning necessitates that Black children first comprehend the printed text. A fortiori, they must first decode the standard English text correctly before comprehending it. It is incorrect to claim that these children have deficient decoding skills. In fact, it is inappropriate to label these children with a reading problem. They know how to read. The variation in oral reading results from a variation in speech that is different from the standard primers' dialect.

At the very least, oral reading is an inappropriate assessment tool when applied to these children unless the "errors" are interpreted in terms of the child's own dialect. Hunt (1974-75) scored Black children's responses on the Gray Oral Reading Test both according to the manual and correcting for dialectal responses. She found an increase of only 0.1 grade level between the two scoring systems, although that difference was statistically significant. However, the better readers (as defined by the standard scoring of the test, but who were still below grade level) were helped more by the dialectal scoring. They gained one-half grade

level on the average with some children gaining more than a whole grade level.

Using oral reading as an instructional device in the classroom must be tempered by a teacher who understands that a child who translates into his/her own dialect is reading correctly (Goodman, 1965a; Goodman & Buck, 1973; Labov, 1967). Otherwise, the teacher may underestimate a child's level of reading achievement and may put undue pressure on the child by constantly "correcting" his/her oral productions. The child also may be confused because he/she may not understand why the teacher is correcting what he/she is reading correctly (Fasold, 1969).

These children who read orally by translating the primers' dialect into their own provide convincing evidence for the comprehension hypothesis. Accurate comprehension (and therefore accurate decoding) must have occurred before the child initiated his/her oral production.

Research on Oral Reading

Given the identification of these two types of readers, one of whom apparently supports each hypothesis, what empirical evidence is available? Three sources of evidence will be reviewed. One source is the analysis of oral reading errors. The errors or miscues are evaluated with respect to the reading processes that

lay behind the performance. A second source of evidence comes from studies of the eye-voice span. If the eye-voice span varies with the semantic, syntactic, and/or conceptual difficulty of the text, then the reader may be comprehending the meaning before uttering the oral production. The third source of evidence comes from a task in which alterations are introduced into the material. The alterations can vary across a wide range of levels, e.g., misspelling, wrong part of speech, semantically anomalous word, or a logical inconsistency. Whether the oral reader is disrupted by a particular level of alteration in the text indicates whether he/she is processing the text to that level of analysis.

Oral reading errors. Most of the analyses of oral reading have emphasized the description of errors that the reader produces as indicative of problem areas in need of additional instruction or remediation. Any deviation from the pronunciation of the printed stimulus is seen as an error in reading, i.e., as an error in the intake of printed information, rather than being a result of differences in speech production. The assumption is that a skilled, fluent reader would make few or no errors in oral reading. Such an assumption is false because even highly skilled readers produce oral reading errors. To reflect this fact and the fact that errors derive from multiple sources, Goodman (1969) has re-termed them "miscues." He defined miscues as "an actual response

in oral reading which does not match the expected response" (Goodman, 1973a, p. 5). The "expected response" is what is normally called "correct" or a standard dialect pronunciation of the printed stimulus.

Another common assumption about oral reading is that it is representative of silent reading in all major respects. Errors in oral reading reflect in overt behavior the same errors that the reader is making covertly in silent reading. Oral reading is one of the few windows that we have on the reading process. However, to the extent that oral reading errors reflect oral production differences, they are not a valid measure of silent reading ability.

A related issue is whether oral reading is a necessary precursor of silent reading, or whether it is an additional task that detracts from silent reading (Weber, 1968). Chall (1967) classified various reading approaches on this dimension. Most phonics proponents, linguistic proponents, and alphabet reformers claim that oral reading is necessary at the beginning to establish the connection to speech comprehension, corresponding to the link between decoding and comprehension in Figure 1. Once that connection has been well established then oral reading may be phased out. On the other side, the basal-reader and a minority of phonics proponents advocate that the child should begin silent reading from the very start. They view oral reading as a performance skill

that can be learned later.

A major problem with the literature on oral reading errors has been the lack of agreement on a classification system to analyze the errors (Weber, 1968). The classification scheme reflects the investigators' underlying assumptions about the nature of the reading process, silent as well as oral reading. Those viewing oral reading primarily as a performance would score hesitations, poor enunciation, and inappropriate intonation and phrasing as errors (Weber, 1968). However, most of the recent studies have focused on the graphic-phonetic similarity and syntactic-semantic acceptability as two major determinants of oral reading errors.

Using specially constructed word lists, Shankweiler and Liberman (1972) found that optical confusability, as exemplified by reversals of letter sequence and orientation, was a much less significant factor in producing oral reading errors than were orthographic factors, such as position of the sound segments and phoneme-grapheme correspondences. Initial segments were better read than medial or final ones, and consonants were read better than vowels. Errors on vowels were predicted by the number of possible orthographic representations.

Using word lists as opposed to prose precludes any evaluation of syntactic and semantic determinants. Shankweiler and Liberman

(1972) justified their use of word lists by the fact that there were significant correlations averaging .70 between oral reading of lists of words and the Gray Oral Reading Test in each of four groups of children. They concluded, "the problems of the beginning reader appear to have more to do with the synthesis of syllables than with scanning of larger chunks of connected text" (Shankweiler & Liberman, 1972, p. 298). However, since the word list data accounted for only about 50% of the variance on the Gray Oral Reading Test, considerable variance remains to be explained by syntactic and semantic components of connected text. Goodman (1965b) reported that many words that were missed when they appeared on a list of isolated words were read correctly when they appeared in a story context. In fact, first graders read 64%, second graders read 75%, and third graders read 82% of the missed words correctly given the syntactic and semantic constraints of the story.

Semantic constraints usually refer to those that result from the meaning of the sentence constraining what lexical items might meaningfully complete the sentence. Semantic information also can refer to lexical access to the meaning of a word in the mental dictionary. Two reported experiments with isolated words are particularly relevant here. One by Perfetti and Hogaboam (1975) reported that more skilled comprehenders were more rapid at word recognition (and pronunciation) than were less skilled comprehenders,

even when all words were known to both groups. The difference between the groups was larger for infrequent than for frequent words. Golinkoff and Rosinski (1976) used a somewhat different task in which automatic semantic access would interfere with the subject's performance on picture naming. They found that, although less skilled comprehenders were weak on decoding, their semantic access skills were not impaired. There is a problem with basing a conclusion on a finding of no difference, but the notion that less skilled comprehenders are not deficient in a critical component in general linguistic processing is useful. Both these results imply that semantic access occurred before the naming response was initiated.

Other investigators have compared the use of graphic and syntactic-semantic constraints in connected text. They have uniformly reported that the syntactic-semantic factors dominate the constraint on errors rather than grapheme-phoneme factors. Out of 7674 substitution errors committed by first graders, Clay (1968) reported that 72% were syntactically appropriate, but only 41% could be attributed to grapheme-phoneme correspondences. Biemiller (1970) found that first graders' graphically similar substitution errors were less frequent than were contextually appropriate substitutions. A similar finding has been reported by Weber (1970a, 1970b); however, good first grade readers were more influenced by

graphic similarity than were poor readers. The influence of visual graphic form appears to constrain the choice of an erroneous response from the set of possible words previously defined by syntactic and semantic constraints. The graphic form of a word does not appear to be a primary factor per se.

That the large majority of substitutions errors in oral reading tend to be syntactically and semantically appropriate is well documented. In one case, oral reading errors of college students were not just syntactically appropriate, but were predicted by a formal grammar, an augmented transition network (Stevens & Rumelhart, 1975). Studies by Biemiller (1970), Clay (1968), Cohen (1974-75), Goodman (1965b), and Weber (1970a, 1970b) reported that first graders' oral reading errors tend to be grammatical and meaningful for the context up to the point of the error. Frequently, the error is grammatically and meaningfully consistent with the remainder of the sentence as well. If not, self-correction usually occurs (Clay, 1969; Goodman, 1965b; Weber, 1970b). Weber (1970a) reported that ungrammatical errors were more graphically similar to the printed word than were the grammatical errors, illustrating a trade-off between these two determinants. Biemiller (1970) studied first graders longitudinally through the first grade. He found an initial phase in which the errors were semantically appropriate to the prior context, but were minimally related to the

graphic form of the stimulus word. Then during a second phase, called the non-response phase, the number of errors dropped and there was an increase in graphically similar substitutions while the contextual substitutions remained constant. Finally, in the third phase the percentage of contextual substitutions increased while graphic substitutions remained stable. A comparable sequence has been reported by Clay (1969) for self-corrections by first grade children (five years old in New Zealand). Initially, errors were self-corrected only if they did not make sense in the context, then visually dissimilar errors were corrected, and finally, both factors were relevant so that only a substitution that made sense as well as was graphically similar was left uncorrected.

There is some evidence that certain types of oral reading errors may be a partial function of the instructional program. The children observed by Biemiller, by Weber, and by Clay were receiving reading instruction in meaning-emphasis programs. Cohen (1974-75) analyzed the oral reading errors of first graders being taught with a code-emphasis approach. Her results were a bit different from Biemiller's in that she found only a few readers who went through an initial phase of giving holistic contextual responses. Instead they started out in a brief non-response phase. In the next phase, these children produced a significant number of nonsense words. Evidently the emphasis on sounding out words and

attempting to pronounce them induced children to make up words based on the graphic stimulus. Following the phase in which nonsense errors predominated, the children began producing meaningful word substitutions as the context gained in importance.

The primary conclusion that one derives from studies of oral reading errors is that readers proceed through the comprehension stage before initiating oral production. How else could syntactic and semantic constraints have such a powerful effect on oral reading errors unless such were the case? Not only is this true for skilled, adult readers, but it also holds for beginning readers and for good readers as well as poor readers. Thus, the comprehension hypothesis is substantially correct and word callers exhibit a clear reading disability that is qualitatively different from typical reading.

While this logic is appealing, we argue that it is incorrect. Because a child makes a grammatically and semantically appropriate error one cannot conclude with certainty that he/she has comprehended the correct meaning for the text. The child may have constructed an interpretation or meaning for the prior text and filled in unknown, missing, or unsampled words on the basis of the constructed meaning. On some occasions the constructed meaning will be the same as the textual meaning, but this does not necessarily indicate that the child correctly processed the word through to its semantic

representation in the sentence and then substituted a synonym at production. If a child accurately comprehended the text prior to making an error (the comprehension hypothesis), then not only would the error be acceptable in the context, but it would be a close paraphrase as well. Furthermore, there would be no need to correct the error because there would be no inconsistency with the remainder of the sentence. However, there is a reasonable probability that a substitution error will be self-corrected because it is ungrammatical or inconsistent with the remainder of the sentence (Clay, 1969; Goodman, 1965b; Weber, 1970b). Such a self-correction strategy implies that the child predicts a meaning, produces an oral response that is appropriate for that meaning, realizes that the substitution is inconsistent with the later text, and then repeats to correct the error.

Our argument is that there are at least two possible mechanisms for syntactically and semantically appropriate errors in oral reading. One is what we originally suggested as the comprehension hypothesis. That is, the error is an output error in which the message was correctly comprehended, but then was translated into the reader's idiolect. This is the mechanism proposed for the dialect readers. The second possible mechanism is that the substitution is generated from the preceding context. In this case, the word is not actually read but a response is produced based

on the semantic representation of the preceding text. This pattern might occur primarily under speed pressure or when the word is unknown but a response is required. This latter mechanism corresponds in many respects to Biemiller's (1970) first phase in which the first graders respond with a contextually appropriate response that may not have a close correspondence to what is actually printed. "The actual graphic display takes second place to grammatical acceptability. Reasonable as this might be as a tactic for the young reader, he must sooner or later read what is actually written rather than what he invents" (Gibson & Levin, 1975, p. 281).

The difference between the two mechanisms may be reflected by comparing the reading errors with the child's own idiolect. If the oral production is an accurate translation of the message of the printed text into the child's idiolect, then one would be justified in concluding that the error represented an output error. If a Black child deleted markers for past tense, third person singular, plurality, or possession (Rosen & Ames, 1970a, 1970b), then one reasonably could conclude that the errors were output errors. But, taking an example from Weber (1970b), if a reader substituted dimes for money, it is more likely that he/she ignored the graphic stimulus and generated the error from the prior context.

Perhaps the two mechanisms can be differentiated by the lev

of the error. Pronunciation and morphological errors occurring at a relatively low level would result from oral production differences, but more complex syntactic and semantic substitutions would represent contextually based responses. This interpretation probably is not adequate. Consider another example from Weber (1970b). She called "I will see what is it" an ungrammatical response to the printed sentence "I will see what it is." It is possible that the erroneous response is grammatical in the child's idiolect. The failure to invert the subject and predicate in embedded relative clauses is one stage in a child's acquisition of embedded clauses (Menyuk, 1969). Although the failure of inversion more typically is found in nursery school children than in first graders, any one of several factors, e.g., slight oral language delay in this particular child, could explain its presence. Although no information was reported about this child's idiolect, the example does illustrate that we cannot identify any particular level of oral reading error as either an output error or a contextual error without a comparison with the child's oral language.

The production of a syntactically and semantically appropriate errors in oral reading does not allow the teacher automatically to infer that the child is comprehending and therefore reading adequately. Only after a comparison with the child's idiolect, rather than a comparison with an adult's responses to the same graphic

stimulus, can one determine whether the error represents a translation based on a veridical semantic representation or a guess based on the preceding text.

Eye-voice span. When moderately skilled readers read aloud, the eye is fixated on the line of print somewhat in advance of the word being vocalized. This difference (typically measured in words) is called the eye-voice span. The eye-voice span is influenced by a number of factors--age and skill level of the reader (Levin & Turner, 1968), difficulty of perceptual processing (Resnick, 1970), syntactic structure (Levin & Kaplan, 1968, 1970; Schlesinger, 1968; Rode, 1974-75), difficulty of the material (Buswell, 1920; Fairbanks, 1937), and task demands for the reading (Levin & Cohn, 1968). Since where the eye is defines the initiation of the reading process and what the mouth is uttering defines the termination of the oral reading process, each factor must have an effect at some point in the intervening process.

For the current discussion, the most important factor among those listed is that syntactic structure increases the eye-voice span and that the eye-voice span tends to terminate at phrase and clause boundaries. The usual interpretation has been that readers read in phrase or clause units. The reader may be actively constructing a hypothesis about what is being read and then testing that hypothesis against the printed text. Thus, if reading is an

active sampling, constructing, and testing process, then one would expect hypothesis generation to be defined by syntactic and semantic units. If so, the reader is comprehending the material before oral production; in fact, it is the semantic representation that permits correct continuations after the visual stimulus has been removed from view.

This interpretation of eye-voice span is subject to the same objection that we voiced to the usual interpretation of syntactic-semantic influence on oral reading errors. To the extent that the eye-voice span is influenced by the preceding context and comprehension of the preceding meaning, then one does not have certain evidence that the reader has in fact comprehended the printed material before vocalizing it. One may object that our argument rests on the premise that the reader has comprehended the preceding material. Although such may indeed be the case, the reader may have comprehended the preceding material only after he/she had vocalized it, perhaps by having comprehension and oral production run in parallel, or perhaps by comprehending the oral output itself. In any case, comprehension prior to initiation of oral production is not required by our premise.

Effects of age on eye-voice span result from differences in reading skill. As readers gain skill, they would be more likely to execute more of the reading process before initiating oral

production. The most common selection criterion for good and poor readers in eye-voice span studies is oral reading rate, (Morton, 1964; Levin & Turner, 1968). Buswell (1920) found a correlation between oral reading rate and a standardized reading test. However, for evidence from good and poor readers to have a direct bearing on differentiating the decoding and comprehension hypotheses, readers would have to be classified independently on decoding and on comprehension skills (Cromer, 1970).

Task demands, either explicit in the instructed purpose for the reading (Levin & Cohn, 1968) or implicit in the difficulty of the material (Buswell, 1920; Fairbanks, 1937), could easily influence the point in the reading process at which oral production is initiated. Even skilled adult readers could be induced to initiate oral production immediately following decoding, if they in fact do not do so usually, by sufficient payoffs for perfectly correct pronunciation.

If readers in eye-voice span experiments are basing their responses in part on informed constructions of preceding material, then there should be errors embedded in the eye-voice span. Rode (1974-75) reported such errors for third, fourth, and fifth graders. On 15% of the trials an erroneous word was substituted for a printed word between two (or more) correct words. She found that 62% of these errors were syntactically and semantically

appropriate and even fewer violated the syntax of the sentence. In a recognition tests following eye-voice span measurements, Levin and Kaplan (1968) found extremely few false positive responses (0.1%), indicating that readers were not purely guessing. But the recognition data and the implied lack of a pure, uninformed guessing strategy do not contradict Rode's results.

Text alterations. While the analysis of sponteneously occurring oral reading errors provides a wealth of information, not infrequently the type of error needed to answer a specific question is not committed. We then are faced with the uncertainty of not knowing whether the reader was not influenced by that particular aspect of reading or whether the text we chose for reading did not give him/her the opportunity to commit such an error. The uncertainty can be alleviated by building inconsistencies into the text at the level we wish to study. If we are interested in whether semantic access occurs, a very infrequent word, one unlikely to be known by the reader, or a pronounceable nonsense word can be inserted into the text. Or if we are interested in whether the reader is integrating sentence meaning, we can insert a word that produces an inconsistency in meaning. If oral reading is disrupted in either instance, then we can reasonably conclude that the text was processed at least to the level of the textual change.

Siler (1973-74) attempted to differentiate between syntactic and semantic determinants of oral reading errors. He introduced semantic disruptions (a word that was the correct part of speech but which was anomalous in context) and syntactic disruptions (inversion of one pair of words). Syntactic disruption produced a larger effect on both oral reading time and oral reading errors than did the semantic one. However, it is difficult to draw a definitive conclusion from these results because there is no common scale on which to compare the syntactic and semantic manipulations (Danks, 1969; Dooling & Danks, 1975).

Lazerson (1974-75) had college students read Caxton's preface to the Eneydos (1490) which was printed in Late Middle English with variable spellings and an archaic syntactic-semantic system. In some conditions, Lazerson corrected only the syntax-semantics to conform with Modern English, or corrected both the spelling and the syntax-semantics. Archaic syntax-semantics increased oral reading time and the addition of variable spelling increased it even more, but there were no differences in comprehension. The variable spelling and the archaic syntax-semantics probably affected the performance system, but not reading-comprehension per se.

In both Siler's and Lazerson's experiments, the disruptions in oral reading were measured in terms of total time and total errors in reading a passage. These overall measures demonstrate

that processing was proceeding to the level of textual alteration, but they are too gross to determine whether the processing was occurring before or after oral production had been initiated. If oral reading disfluencies are measured relative to a specific alteration in the text, then the point of initiation of oral production can be specified more precisely. Where the oral reading disfluency occurs relative to the change in the text provides a means of discriminating between the decoding and comprehension hypotheses. If the disfluency occurs before the reader has uttered the altered part of the text, then the text must have been processed to that level prior to initiating production. However, if the disfluency occurs only some distance after the altered section has been uttered, then the processing at that level occurred much later, perhaps even in response to the oral output itself.

Three experiments have used a more precise procedure of introducing specific alterations and measuring oral reading disfluencies in the immediately surrounding text. These three experiments have introduced the alterations at three different levels of processing--lexical access, syntactic and semantic integration, and intersentence integration.

In order to determine the effects of disrupting lexical access, Miller (1975) introduced four types of modifications into paragraphs--infrequent words, pronounceable nonsense words with and

without syntactic markers, and phonologically impossible sequences. He measured errors in the original text surrounding the inserted word; hesitations, incorrect intonation, and other performance variables were not measured. In second graders' oral reading, there were increased errors on the two words immediately preceding and following the inserted word, but there was no effect of the type of text alteration. Since none of the inserted words were available in the mental dictionary of the child (including the infrequent words), the reader was unable to locate the word in the mental dictionary before pronouncing it. Thus, semantic access was occurring prior to oral output.

Miller and Isakson (1976) assessed intra-sentence integration by substituting verbs in sentences. Semantic integration was disrupted by replacing a transitive verb with another transitive verb that was semantically unacceptable. For example, paid replaced the verb planted in the sentence "The old farmer planted the bean seeds in the rich, brown soil." Both syntactic and semantic integration were disrupted by substituting an intransitive verb that was semantically anomalous as well, e.g., went in the above sentence. Subjects were groups of fourth graders that had been divided into good and poor comprehenders (more than or less than one-half year above or below grade level placement on the reading comprehension subtest of the Iowa Test of Basic Skills, respectively;

all readers were within one-half year of grade placement on the vocabulary subtest). The only effect of the verb substitutions was increased oral reading errors at the verb position itself by good comprehenders. Only the readers that were performing at a relatively high level of comprehension skill were processing the semantic and syntactic information. The results suggest that integration was occurring prior to the initiation of the oral response since the production of the altered word itself was disrupted. Perhaps with even more skilled readers, the disruption would occur one or more words prior to the utterance of the altered word.

In a recently completed study, we[2] assessed the disruptive effect of an inconsistency introduced into the text. Within a paragraph, a sentence was altered such that it was inconsistent with a single critical word in the next sentence, but not inconsistent with the rest of the paragraph either preceding or following. For example, in the following pair of sentences (taken from Patton's memoirs of World War II), "...I then told him that, in spite of my most diligent efforts, there would be some raping. I should like to have the details as early as possible so that we can hang these men. He said that this was...," the first sentence was replaced with "I told him there would unquestionably be some helping by the soldiers," which produced an inconsistency with the

critical word hang in the second sentence. Note that the second sentence containing the critical word was not altered in any way. There were 10 experimental paragraphs and the location of the text alteration varied in the paragraphs. Two groups of 10 college students read these passages aloud. Half of the passages for each group were altered to produce the inconsistency and half remained unchanged. Complementary sets of changed and unchanged passages were presented to the two groups of readers. The intervals between each of the five words preceding and following the critical word in the second sentence, as well as the length of time to say the critical word itself, were measured by slowing the tape recorder to one-fourth speed. Because the latency distributions were skewed, the data were transformed logrithmically.

Subtracting the control group means from the experimental group means, the curve depicting differences in interword latencies across position in the sentence showed a disruption beginning about two word intervals prior to the critical word and continuing for three word intervals following the critical word. There was considerable variability among paragraphs, however, so that while the mean differences over interword positions was significant across readers, it was not significant across paragraphs. (The example described in the preceding paragraph was significant, however.) The time to say the critical word itself was longer for the

experimental group than for the control group, a difference that was significant across both readers and passages simultaneously.

The results suggest that the reader had comprehended the material not only prior to initiating oral production of the critical word, but before uttering at least one word before the critical word. Detection of the inconsistency required a detailed and integrated comprehension. It depended not just on access to the lexical item in semantic memory and not just on comprehension of the sentence currently being uttered, but on integration with the semantic representation of the preceding sentence as well. This integration with prior extra-sentential context requires additional time to accomplish (Dooling, 1972). Even if one assumes a constructive or top-down comprehension process, the match between the expected meaning of the second sentence and the actual meaning must have occurred at an abstract level of representation. Thus, comprehension must have occurred well ahead of oral production, and to a deep level of processing.

The Two Hypotheses Revisited

Our conclusion from the literature review is that neither the decoding nor the comprehension hypothesis holds all the time, but that the particular processes involved in oral reading are reader and task specific. A given reader with specific materials and a definite purpose for reading will process the text to the extent

that he/she is capable and to an extent consistent with the implicit or explicit purpose. The reader then will initiate the oral production process at that point. Word callers are unable to progress beyond the decoding stage before initiating their oral production, but dialectal speakers are able to comprehend the text before initiating production. Reader limitations, textual variation, and purpose effects apply in somewhat different fashions. The reading level of the reader, whether limited by level of acquisition (age or grade level) or by skill (good and poor readers), is a limitation of the system. It sets an upper limit on the level of processing that the reader is able to attain. The other two factors, difficulty of the text and the purpose of reading, result in variation in the level of processing below the maximum set by the reader's ability.

Reading level. The level of reading skill sets an upper bound on the processing that a reader can accomplish prior to the initiation of oral production. A limitation resulting from level of acquisition is most often indexed by the age or the grade level of the child. Good and poor readers typically are defined by whether or not they exceed or fall below the grade level corresponding to their chronological age. Given that there is a more or less orderly progression in the acquisition of reading skill, the level of reading acquisition will determine the maximal extent

of processing before oral production is initiated.

The level of processing is not independent of rate of processing and memory limitations. There is evidence that children do not differ from adults in the absolute size of their memory capacity, but that children use their memory stores less efficiently (Chi, in press). This impoverished ability to control and to select the relevant information to be stored is particularly critical in reading where the input is under the control of the reader and the integration of information must occur over a span of input. The reader must develop strategies for the efficient intake of printed information. The rate must be sufficiently fast so that the requisite information exists simultaneously in memory so that it can be integrated.

However, if the initial stages of the reading process are not sufficiently fluent, or are not sufficiently automatic to proceed with minimal or no attention, then the rate of input will not be sufficiently rapid to overcome memory limitations. The beginning phases of reading acquisition are occupied with the practice of decoding skills. When they become sufficiently automatic, attention can be directed to the later comprehension stages (LaBerge & Samuels, 1974).

With increasing age the reader becomes better able to control the strategies involved in processing so that they can be directed

toward the particular task set for him/her. Just as he/she can better control the strategies involved in the efficient storage and retrieval of material, he/she can also control the reading process to particular ends.

Purpose or task. The reading task influences the level of processing accomplished. Keeping in mind that the level of reading acquisition sets an upper limit and that the age of the reader may determine his/her ability to control the reading strategies, a reader can focus on decoding, on comprehension, or on oral production. If the reader expects to be tested on his/her knowledge of the content of the passage, then the reader will process the passage to a deeper level of meaning. However, if the reader is being evaluated (either implicitly or explicitly) solely on oral production, then he/she may focus his/her attention on decoding and pronunciation, thereby ignoring comprehension. Adults reading to an audience are likely to focus attention on decoding and oral performance, and not be able to recall much of what was read.

For the school child who must read for the teacher with the class listening, he/she will probably pay particular attention to decoding and oral production so as not to make a mistake. Typically the teacher and the other children are following the text, so that they will know immediately if he/she makes a mistake.

This situation produces considerable pressure on the child to be correct in his/her oral productions and to let comprehension of the passage pass by. Pehrsson (1974) tested fifth graders under such conditions. When the teacher focused attention on correct decoding and oral production, reading rate and comprehension decreased, as one might expect. But unexpectedly, oral reading errors increased. In contrast to Pehrsson's results, if the child has to retell what he/she has read following oral reading, then he/she is more likely to pay attention to comprehension.

Text difficulty. The text for the reader can vary in difficulty at several different levels. The type font may make it difficult to discriminate the letters, the vocabulary may be difficult, the syntactic structure may be complex, and the ideas and conceptual organization may be abstract or obscure. These levels of difficulty will interact with the level of reading that the reader is capable of. If the reader is concentrating his/her attention on decoding, either because of ability limitations or task orientation, then the complexity of the syntax and the difficulty of the conceptual structure will not have an effect on oral production. This is simply a restatement of the rationale for the text alteration studies mentioned previously. If there was an inconsistency at a higher level than the reader was capable of processing, then there would be no disfluency in oral production.

Comprehension processes in oral reading cannot be evaluated by using a list of words. Lexical access can be assessed, but the meaning of isolated words is but a small part of the processes involved in the comprehension of paragraphs. In prose comprehension, words must be amalgamated for sentence meaning and sentences integrated for textual meaning.

In summary, the decoding hypothesis of oral reading holds in certain contexts, with particular materials, and for certain types of readers and the comprehension hypothesis holds in others. All three factors interact to determine the specific level of processing to which the reader will process the text. It is impossible to come to a single conclusion as to whether the decoding hypothesis or the comprehension hypothesis is correct because which one holds is conditioned by these other factors.

Postscript

In his comments on our paper at the conference, Tom Trabasso discussed the lack of clear definitions of decoding and comprehension. Decoding typically refers to the translation of print input into an appropriate phonological code. Comprehension refers to the process of extracting meaning from the phonological code. Neither of these definitions *is* precise enough to know what operations one might use to investigate each. Trabasso correctly

asserted the need for procedural definitions of decoding and comprehension.

The basic rationale behind our discussion of the research in oral reading was that oral reading reflects processing at a variety of levels. Oral reading errors can be classified as being related to the graphic properties of the stimulus, or as related to syntax or semantics. Several levels of processing in reading can be identified in terms of procedures used to introduce alterations in text, the effect of which are measured by disfluencies in oral reading. At the lower processing levels, perceptual processes can be disrupted by physically blurring words so that distinguishing the critical properties is more difficult. Graphic familarity can be altered by switching type faces or by changes in handwriting. The effect of disrupting some higher processing levels was evaluated in the experiments reviewed. Lexical access was assessed by inserting very infrequent words or pronounceable nonwords (Miller, 1975). Whether the reader was integrating words within a sentence was determined by whether semantically and syntactically inappropriate words disrupted oral reading (Miller & Isakson, 1976). Finally, we assessed inter-sentence integration by building inconsistencies between sentences in a passage.

The processing hierarchy described in the preceding paragraph

effectively has eliminated the need for a distinction between decoding and comprehension. Which processing levels tap decoding and which tap comprehension? The distinction is no longer formally necessary because the levels of processing in reading have been defined by the particular operations used to disrupt each processing level.

The original question as to whether oral production is initiated after decoding or after comprehension has been divided. One question is whether or not a particular level of processing (as defined by a manipulation of the text) is involved in oral reading. Any disruption in oral reading would provide evidence of processing at that level. The second question is whether oral production is initiated before or after processing at a particular level has occurred. This question is answered by the point of disfluency in oral reading relative to the point of alteration in the text. Disfluencies prior to when the altered text is uttered indicate processing at that level has been completed; disfluences after the altered text has been uttered indicate oral production was initiated prior to processing at that level.

With the proposed rationale it is not necessary to have a comprehensive model of reading, although one will be implicit in the selection of what processing levels are interesting to

manipulate. We do not claim that the processing hierarchy described above is exhaustive or definitive, but it does illustrate a functional procedure by which one can study reading processes.

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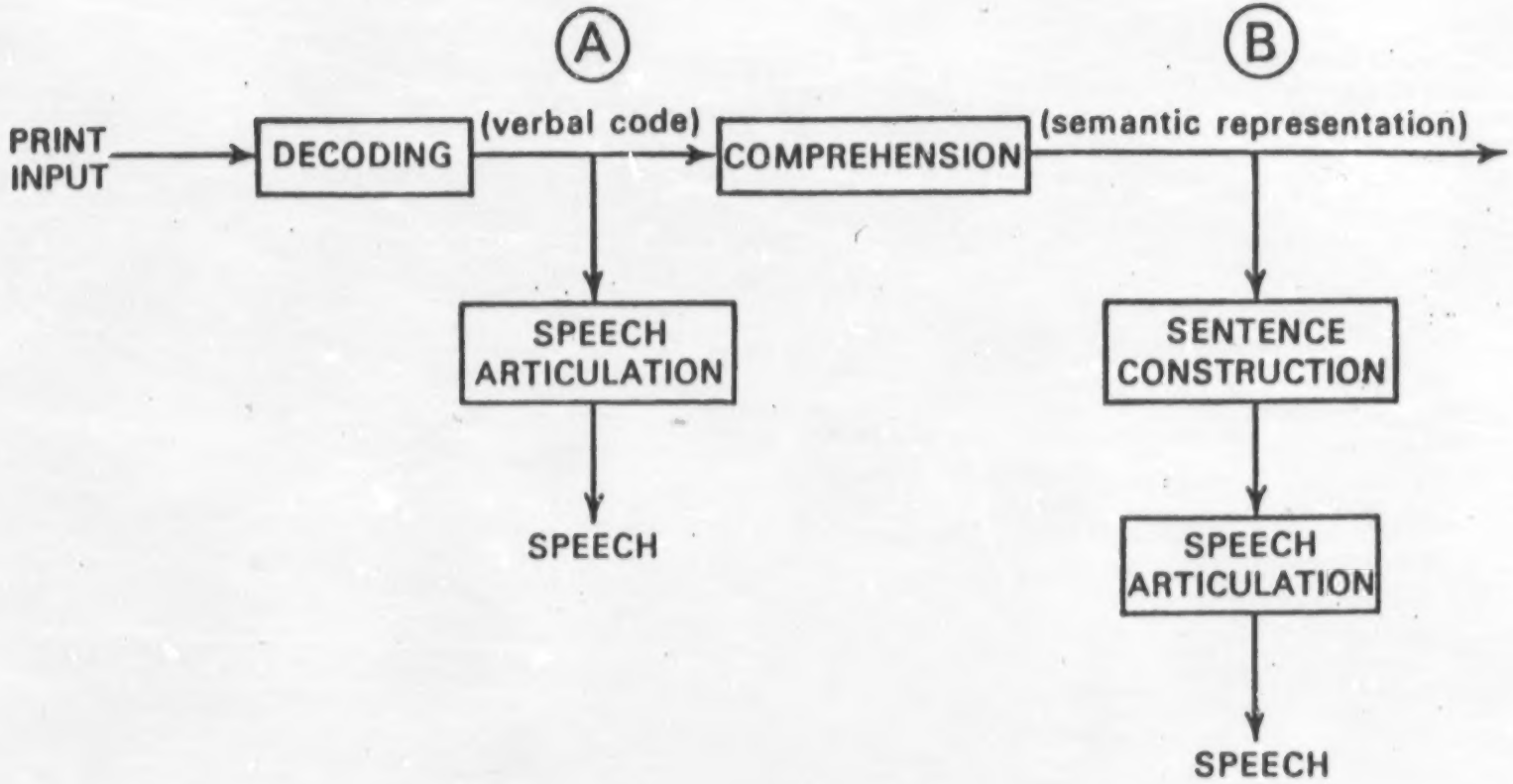
Footnotes

1. The preparation of this paper was supported in part by Grant No. MH 21230-02 from the National Institute of Mental Health.

2. This experiment was designed in collaboration with Karen Fischer. We thank Mark Germano for his assistance in conducting the experiment.

Figure Caption

Figure 1. Two hypotheses about oral reading performance.


A
B
PRINT INPUT
DECODING
(verbal code)
COMPREHENSION
(semantic representation)
SPEECH ARTICULATION
SPEECH
SENTENCE CONSTRUCTION
SPEECH ARTICULATION
SPEECH

June 7--A.M.

OPEN DISCUSSION OF DANKS PRESENTATION

SUPPES: I thought of a test that would be interesting along the lines you are talking about. How well can a trained listener judge by a child's oral production, whether he is comprehending? And are there any experiments of that kind? And let me give a prologue before you answer that. For rather different reasons, I have recently gotten quite interested in prosodic features. It is a great muddle from an analytical standpoint, as to exactly how we analyze and we organize, theoretically, prosodic features. I take it that what you are saying is that an oral reader gives away his degree of comprehension by the prosodic features of his speech. I would be interested in how well we can actually judge that in a predictive fashion. And do you know of any experiments?

DANKS: I don't know of any experiments on that point.

SUPPES: So you don't know whether you can judge oral production or not?

DANKS: No.

I, like you, feel that we could probably judge level of comprehension fairly well particularly those teachers who have had more experience listening to oral reading. Perhaps some of the teachers in the audience can comment.

BECK: I think skilled people can judge quite well, I think I can. Out of curiosity, I would like to be given a test some time to assess how well I can. But I am aware that when I go through the classrooms and listen to kids read, I seem to be able to make judgments then. I know that when Helen Popp recently visited our classrooms, she could judge very well, too.

June 7--A.M.

POPP: They can fool you.

BECK: It's true they do fool you once in awhile.

DANKS: It would be superficially easy to set up such an experiment.

SUPPES: We want more, though, than the judgment. If you can do it, then you have to be able to categorize what features are present and missing in the prosodic features.

McCONKIE: What about the computer?

SUPPES: Well, actually the reason I got interested in it is we are trying to get our computer to talk right, and it turns out that the linguistic analysis required is in very poor shape.

RESNICK: You haven't given him conditions under which the decoding strategy would be the adaptive one. It looks like it is what some people do when they can't do anything better. Or have I misunderstood?

DANKS: I think that's true, although I'm not a classroom teacher; but I suspect it may be even adaptive in a classroom.

RESNICK: Sometimes it needs the teachers, then.

DANKS: Yes. How many of the classroom teachers here would correct a child, or say something to a child, if you suspected that the child was not reading with

comprehension based on the intonation cues? Would you let that pass and say, "I have enough problems," or would you try to evaluate a specific child's oral production? Assume you had evidence that the child was not comprehending, perhaps through story retelling, and that you are in the usual classroom as opposed to when you are giving individualized instruction.

RESNICK: There are lots of examples of teachers that say, "Read with feeling."

DANKS: But that exhortation may not get the child to actually comprehend.

RESNICK: It gets kids to produce a lot of prosodic features.

END SESSION